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Good intra-operative anaesthesia is more than an “ABCD with a three, two and a one”.

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Editorial

Good intra-operative anaesthesia is more than an "ABCD with a three, two and a one".

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Summary

The adoption of checklists within healthcare leads to improvements in patient safety. Perioperative management of patients with comorbidity and polypharmacy is complex and whilst physical checklists, aviation style computerised checklists, and mnemonics can all be used to make anaesthesia safer, these cannot cover the entirety or the complexity of perioperative care, and in particular, the principles by which anaesthetists work to promote restoration of function. Restoration of function is increasingly being seen as the marker of good anaesthetic care.

Good intra-operative anaesthesia is more than an "ABCD with a three, two and a one".

I shall not today attempt further to define the kinds of material …… , and perhaps I could never succeed in intelligibly doing so. But I know it when I see it.

Judge Potter Stewart. Supreme Court Judge

In this month's *Anaesthesia*, Jelasic and colleagues report that the risk of missing critical pre-induction items and the risk of non-routine events can both be reduced through the use of an aviation-style computerised checklist [1]. In their study, a second anaesthesia provider verified the satisfactory completion of 16 pre-induction steps. It is noteworthy that nine of these steps are either part of the sign in section of the WHO checklist [2] or part of the AAGBI safety guideline on checking anaesthetic equipment [3]. Many of the prompts that are part of neither of the aforementioned checklists include confirmation that a physiological measurement is actually being recorded and as such moves beyond the simple verification of the monitor being present, for instance the presence of an end tidal CO_2 tracing on the monitor. This specific prompt encourages both pre-oxygenation and also mitigates against inadvertent oesophageal intubation, especially if the anaesthetists adhere to the "No Trace = Wrong Place" campaign [4], and is therefore is a useful addition.

The use of checklists has been shown to improve human performance in many situations both within and external to healthcare. [5] Jelacic et al's study complements work recently published by Ramsey et al, finding a reduction in

surgical mortality in Scotland associated with the introduction of the WHO Surgical Safety Checklist [6]. However, not all studies of checklist implementation at scale have been able to demonstrate clinical benefits, particularly when evaluating implementation outside the research setting and at scale across multiple centres [7]. In part this may be due to a lack of fidelity of this 'simple' intervention when applied at scale – i.e. ticking a box does not necessarily imply true compliance with a process. Challenges with encouraging behavioural change, supporting implementation processes and avoiding checklist fatigue may all be contributory [8]. The design of the intervention in Jelacic's study – that is, the involvement of two people in the process, to complete and then verify the checklist – provides a neat methodology for avoiding some of these problems, and has been used in other industries where verification is critical. Importantly therefore, while this study provides a signal that this methodology can improve processes and outcomes, it is important to note its limitations – as a single centre study (and therefore of uncertain generalisability) and that despite the significant benefits observed, over 17% of cases still had no checklist completed – implying incomplete adoption, and reinforcing the need for continuous, focused support for implementation of even seemingly straightforward interventions. Further validation of these findings, both through sustained evaluation in their vanguard centre, and in other centres which reflect different clinical and organisational settings, would be beneficial.

Despite these challenges, the rationale of Jelacic's study will be familiar to all involved in anaesthetic practice. As anaesthetists we have used checklists for promoting safe anaesthesia since at least 1990, when the Association of Anaesthetists published its first edition of the anaesthetic machine checklist [9]. A novel question might be to ask whether checklists can be used to help promote <u>good</u> as well as <u>safe</u> intra-operative care? Comprehensively defining good intra-operative care may be difficult but, to paraphrase Supreme Court judge Potter Stewart, "we know it when we see it". We appreciate that good intra-operative anaesthetic care supports better clinical outcomes, and that an absence of complications is beneficial for both the patient and society [10,11]. It is also known from day-surgery and enhanced recovery pathways, that anaesthesia which promotes a rapid return to normal function is beneficial [12,13]. The changing demographics of the surgical population, with increasing age and multimorbidity, necessitates multidisciplinary

collaboration to ensure that complex patients are supported to early restoration of function including Drinking, Eating and Mobilising (DrEaMing)[14]. This demands the provision of good intra-operative anaesthetic care. Therefore, it is imperative that we define what constitutes 'good' intra-operative anaesthetic care. At its simplest, we can consider this to be the avoidance of end-organ dysfunction, accidental awareness during general anaesthesia (AAGA), and the creation of a physiological state which facilitates rapid restoration of normal homeostatic, physical and psychological function. Early restoration of function is promoted by enhanced recovery, and good analgesia and anaesthesia are critically important in achieving these goals [15].

In 2014, the Fifth National Audit Project (NAP5) was published which examined the incidence of AAGA as well as examining the risk factors for its occurrence [16]. This has been supplemented by the NAP5 handbook [17]. Both documents recognise the importance of preventing end-organ dysfunction and AAGA by advocating the routine use of the mental checklist/ mnemonic: "ABCD" (airway, breathing, circulation, drugs). The "D" is to prompt the anaesthetist to ensure ongoing delivery of anaesthetic drugs. They argued that this mnemonic should be used after induction, on transfer, after positioning and just prior to incision. The suggestion of the NAP5 authors in using a mnemonic to promote safe anaesthesia is a natural progression as the profession embraces the routine use of checklists.

In January 2018, the Association of Anaesthetists released the Quick Reference Handbook (QRH) [18]. The QRH is designed to be used only during critical incidents and is a collection of checklists to manage most of the critical incidents that an anaesthetist might be expected to competently deal with. The QRH uses the ABCD mnemonic in the management of many critical incidents - however here "D" reflects "depth" of anaesthesia. The ABCD mnemonic is a useful aide memoire. However, contemporary studies have demonstrated that the presence of an ABC is not always sufficient to prevent end-organ dysfunction, as amongst other clinical variables, hypotension, tachycardia and dysglycaemia are associated with poor outcome [19-26]. This concept is also in line with the aviation checklist proposed by Jelacic et al, as they advocate the necessity of agreeing blood pressure and heart rate goals before commencement of anaesthesia [1]. Therefore, for the ABCD mnemonic to be

useful in preventing complications, rather than purely a simple emergency prompt, it must evolve and take into account the requirement to maintain physiological variables within an optimal range.

The maintenance of adequate perfusion pressure to cardiac, cerebral, and renal vascular beds is vital for the maintenance of end-organ function. However, the relationship between perioperative blood pressure and outcome is more nuanced than a simple unidirectional relationship, as elevated blood pressures and increased blood pressure variability are also associated with complications [19-22]. As well as considering absolute blood pressure values, or variation in values there is also the question of which blood pressure index carries the most useful prognostic information. Physiological arguments can be made to focus either on the diastolic blood pressure (DBP) for coronary perfusion or mean arterial pressure (MAP) for neurological, and renal perfusion. However, the VISION study highlights the increased odds of myocardial injury after non-cardiac surgery (MINS) and mortality that occur with an intraoperative systolic blood pressure (SBP) of less than 100mmHg [19]. Thus, it can be argued that in the absence of other competing clinical requirements the SBP should be maintained in three sensible digits. This is also compatible with the findings of the Perioperative Quality Initiative group [22]. Maintaining the SBP in **three sensible digits** has other advantages, including tangibility for novice anaesthetists.

The presence of tachycardia under anaesthesia can be an important physiological indicator of multiple events such as overt, or concealed haemorrhage, sepsis, pain or inadequate levels of analgesia [23]. Previous research has highlighted the association between intraoperative HR >100 bpm and MINS, myocardial infarction and mortality. This effect is compounded if the tachycardia was associated with an SBP <100 mmHg [19]. Many anaesthetists would view tachycardia as a sign heralding risk of myocardial injury, AAGA and pain. Thus, within reason, taking action to ensure that the heart rate in adults remains in **two sensible digits** has merit.

There is a well-recognised association between a perioperative blood sugar > 10 $mmol.l^{-1}$ and the risk of peri-operative complications including death in patients with either diagnosed and undiagnosed diabetes [24,25]. In addition, as a blood glucose of <4 $mmol.l^{-1}$ is associated with excess morbidity, mortality and increased length of stay [26], it is recommended that the blood sugar on patients on glucose lowering medication should be kept above 5 $mmol.l^{-1}$ [27]. Thus, there is a rationale to keeping the blood sugar to **one sensible digit**.

With increasing comorbidity, coupled with increasing frailty and age of the surgical population, the goal of early restoration of function has never been more important. To achieve this, it necessary to ensure that patients have other physiological variables optimised. These variables are diverse and include: avoidance of remnant neuromuscular blockade [28]; prevention of the deadly triad (acidosis, coagulopathy and hypothermia) [29]; procedure specific analgesia to facilitate mobilisation [30] ; consideration of age-related dose of anaesthesia to reduce the risk of perioperative neurocognitive disorders (PNCD) [31]; avoidance of drugs that may precipitate/aggravate PNCD [31]; and strategies to avoid perioperative gastrointestinal dysfunction and promotion of early drinking and eating [14].

So – can we deconstruct the complicated process of delivering the highest quality anaesthesia to a simple mnemonic – an ABCD with a three, two and a one? Clearly this 7-character mnemonic does not encompass all the facets that are known to contribute to good intraoperative care, as it does not encompass restoration of function. However, this mnemonic can be used as a tool for prompting the consideration of the vitally important aspects of anaesthesia that are important at every juncture: induction, transfer, start of surgery, insufflation, maintenance, emergence, and handover i.e. it can be considered the ‘backstop’ of safe anaesthesia. In addition, as advocated in the QRH, the mnemonic has a role in managing critical incidents, when the patient’s condition, and the clinician’s ability to think logically and clearly, might be deteriorating.

The care of humans with multiple health issues undergoing anaesthesia for surgery is not just complicated, it is complex. Checklists and mnemonics can all be used to make anaesthesia safer - but these cannot cover the entirety or the complexity of

perioperative care, and in particular, the principles by which anaesthetists work to promote restoration of function. Whilst acknowledging the importance of maintaining ABCD with a sensible three, two, and one, there is still the need for anaesthetists to exercise their professional judgement regarding the specific needs of individual patients, in order to ensure the anaesthetic is not only safe but is *good,* by promoting restoration of function.

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